Out-of-plane exchange bias and magnetic anisotropy in MnPd/Co multilayers

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Abstract: Magnetic and structural properties in $[MnPd/Co]_{10}$ multilayers deposited onto Si(1 1 1) substrates have been investigated. The dependences of anisotropy and exchange bias on the thicknesses of both MnPd and Co layers have been studied. In most of the samples, the out-of-plane magnetic anisotropy and both large out-of-plane and in-plane exchange biases have been observed at cryogenic temperature below the blocking temperature T_B??240 K. With appropriate MnPd and Co thicknesses, we have obtained samples with a large out-of-plane exchange bias along with a large out-of-plane magnetic anisotropy. The origin of the out-of-plane magnetic anisotropy in the samples has been suggested to be due to the formation of CoPd interfacial alloys which have tensile in-plane strains, while the spin structure of the antiferromagnetic layer at the interface which is believed to be responsible for exchange bias may be the same as that of the bulk material. Also, the present study shows that the interplay between the out-of-plane magnetic anisotropy and exchange bias is evident in our multilayers and plays an important role in the out-of-plane exchange-bias mechanism. ?? 2008 Elsevier B.V. All rights reserved.

Author Keywords: Magnetic thin film; Multilayer; Out-of-plane exchange bias; Out-of-plane magnetic anisotropy

Index Keywords: Magnetic anisotropy; Magnetic multilayers; Magnetic thin film; Multilayer; Out-of-plane exchange bias; Out-of-plane magnetic anisotropy; Magnetic properties

Year: 2008

Source title: Journal of Magnetism and Magnetic Materials

Volume: 320

Issue: 23

Page : 3334-3340

Cited by: 1

Link: Scorpus Link

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ISSN: 3048853

CODEN: JMMMD

DOI: 10.1016/j.jmmm.2008.07.007

Language of Original Document: English

Abbreviated Source Title: Journal of Magnetism and Magnetic Materials

Document Type: Article

Source: Scopus

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References:

1. Meiklejohn, W.H., Bean, C.P., (1956) Phys. Rev., 102, p. 1413
2. Kagerer, B., Binek, Ch., Kleemann, W., (2000) J. Magn. Magn. Mater., 217, p. 139
3. Binek, Ch., Kagerer, B., Kainz, S., Kleemann, W., (2001) J. Magn. Magn. Mater., 226-230, p. 1814
4. Matt, S., Takano, K., Parkin, S.S.P., Fullerton, E.E., (2001) Phys. Rev. Lett., 87, p. 087202
5. Marrows, C.H., (2003) Phys. Rev. B, 68, p. 012405
6. Garcia, F., Sort, J., Rodmacq, B., Auffret, S., Dieny, B., (2003) Appl. Phys. Lett., 83, p. 3537
7. Liu, Z.Y., (2004) J. Magn. Magn. Mater., 281, p. 247
8. Sort, J., Garcia, F., Auffret, S., Rodmacq, B., Dieny, B., Langlais, V., Suri?ach, S., Nogu??s, J., (2005) Appl. Phys. Lett., 87, p. 242504
9. Sun, L., Searson, P.C., Chien, C.L., (2005) Phys. Rev. B, 71, p. 012417
10. Phuoc, N.N., Suzuki, T., (2006) J. Appl. Phys., 99, pp. 08C107
11. Phuoc, N.N., Suzuki, T., (2006) IEEE Trans. Magn., 42, p. 2996
12. Kim, S.S., Hwang, J.Y., Rhee, J.R., (2007) J. Magn. Magn. Mater., 310, p. 2310
13. Phuoc, N.N., Suzuki, T., (2008) J. Appl. Phys., 103, pp. 07C113
14. Thuy, N.P., Tuan, N.A., Phuoc, N.N., Nam, N.T., Hien, T.D., Hai, N.H., (2006) J. Magn. Magn. Mater., 304, p. 41
15. Kim, S.K., Chernov, V.A., Koo, Y.M., (1997) J. Magn. Magn. Mater., 170, pp. L7
16. Hong, J.I., Sankar, S., Berkowitz, A.E., Egelhoff Jr, W.F., (2005) J. Magn. Magn. Mater., 285, p. 359
17. Kim, S.K., Lee, J.W., Jeong, J.R., Shin, S.C., (2002) J. Magn. Magn. Mater., 240, p. 543
18. Johnson, M.T., Bloemen, P.J.H., den Broeder, F.J.A., de Vries, J.J., (1996) Rep. Prog. Phys., 59, p. 1409
19. Engel, B.N., England, C.D., van Leeuwen, R.A., Wiedmann, M.H., Falco, C.M., (1991) Phys. Rev. Lett., 67, p. 1910
20. Charlton, T., McChesney, J., Lederman, D., Zhang, F., Zachary Hilt, J., Michael, A., Pechan, J., (1999) Phys. Rev. B, 59, p. 11897
21. Br?ck, S., Sort, J., Baltz, V., Suri?ach, S., Mu?oz, J.S., Dieny, B., Bar??, M.D., Nogu??s, J., (2005) Adv. Mater., 17, p. 2978
22. Roshchin, I.V., Petracic, O., Morales, R., Li, Z.-P., Batlle, X., Schuller, I.K., (2005) Europhys. Lett., 71, p. 297

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